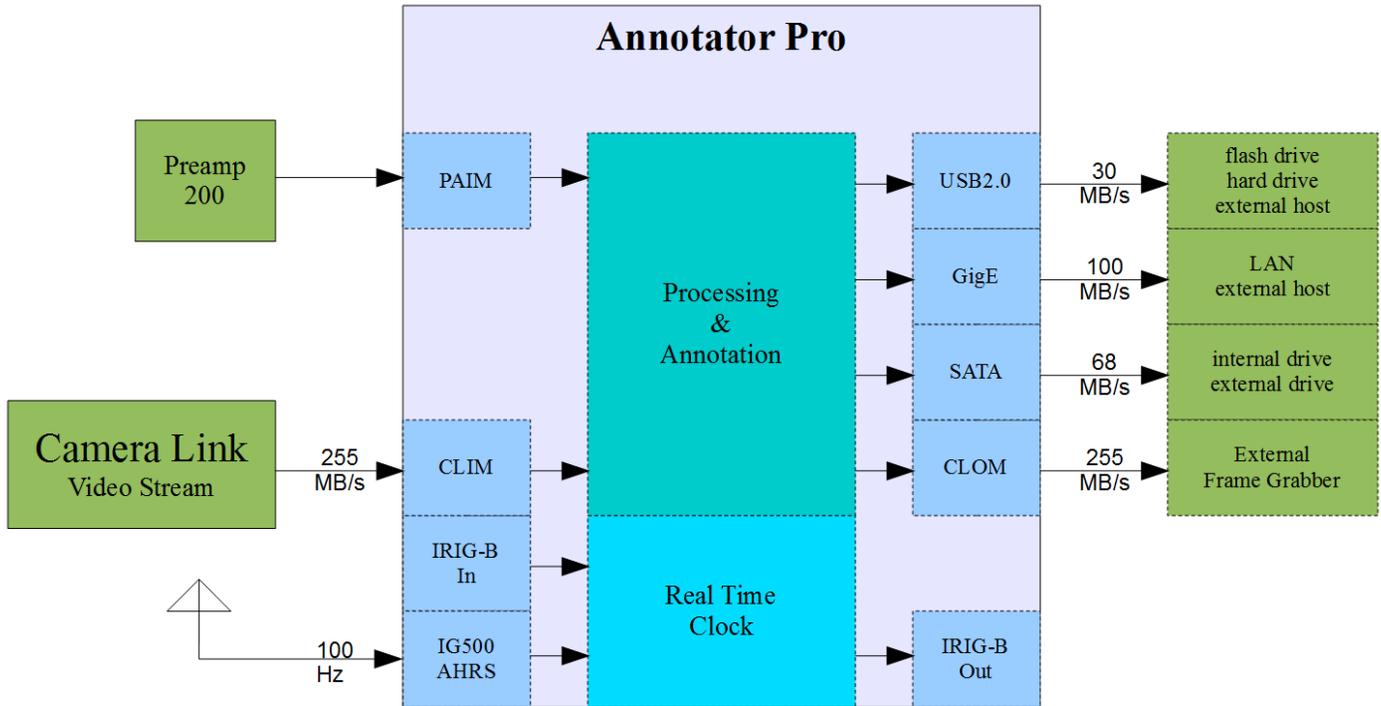




# Annotator Pro

Hybrid Data Acquisition Device

The Annotator Pro is a hybrid device that combines multiple functions that have traditionally been performed individually by frame grabbers, microcomputers, time code generators, GPS receivers, AHRS/INS systems, and custom software applications. The Annotator Pro provides the same annotation features as other Annotators, with additional data acquisition, annotation, and processing capability. Multiple interface options provides much flexibility. The Annotator Pro can be embedded into end user equipment, configured in a standalone enclosure, or placed in a rack-mountable chassis.



- Features**
- Each Annotator Pro can support multiple cameras or other instruments (for example, 3 CL-base inputs, with 3 CL-base outputs)
  - Can act as a multi-channel splitter (for example, 1 CL in to 4 CL out)
  - Can act as a video mux (for example, 4 CL inputs to 1 CL output)
  - Includes built-in pattern generator for testing
  - Multiple control interface options (RS232, RS422, LVDS, USB, Ethernet)
  - Precision time synchronization from GPS or IRIG-B
  - The baseboard is designed around an Altera Cyclone IV FPGA and a dual-core ARM CPU
  - USB, SATA, Gigabit Ethernet, and IRIG-B are integrated directly on the baseboard

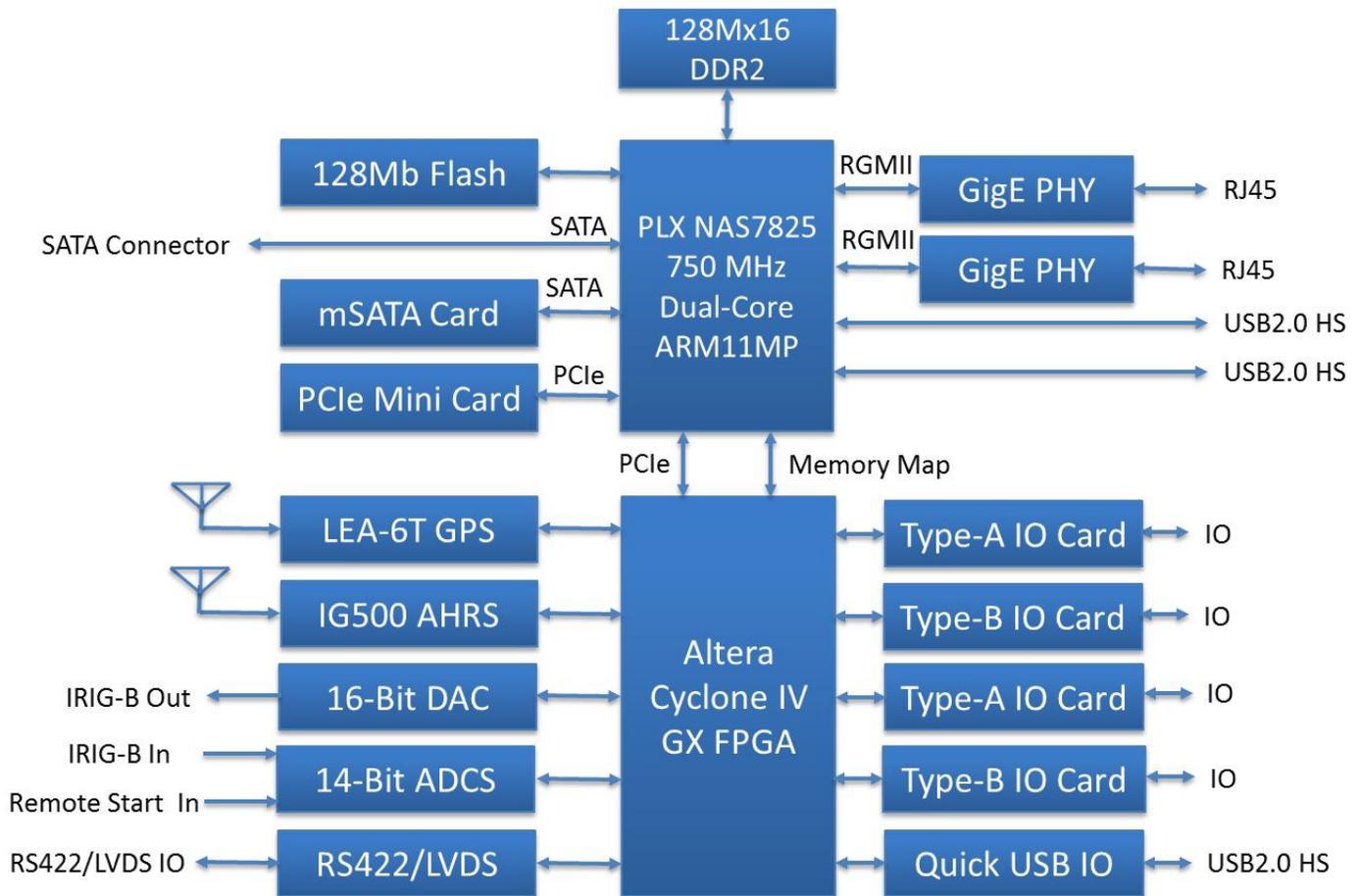
**Data Interface** Modular I/O interface allows for multiple configuration and data format options (Camera Link, multi-channel analog, IR detector preamp, others)

**Power Requirements** 9-36 Volts DC

**Dimensions** Board size is 160 x 100 mm

**Part Number** Annotator-Pro

**Price** Contact us for configuration and pricing options



*Annotator Pro Functional Block Diagram*

## **Multiple Data Formats**

The Annotator Pro supports various data formats through pluggable I/O modules. Each Annotator Pro can accept 4 I/O modules. The modular I/O interface allows multiple configurations to be built around a common baseboard. Any number of possible configurations are possible using appropriate piggyback I/O modules. These modules are interchangeable and can be configured to suit a variety of applications. The following modules are available:

- ADC16 (16-channel A/D converter)
- CLIM (Camera Link Input Module)
- CLOM (Camera Link Output Module)
- CLIM3-MDR (3-channel Camera Link Input Module with MDR connectors)
- CLIM3-SDR (3-channel Camera Link Input Module with SDR connectors)
- CLOM3-MDR (3-channel Camera Link Output Module with MDR connectors)
- CLOM3-SDR (3-channel Camera Link Output Module with SDR connectors)
- PAIM (PreAmp-200 Interface Module)



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## **Pluggable I/O Interface**

The Annotator Pro baseboard supports modular I/O via optional piggyback modules. There are four module slots per board. Each of these modules is connected to the baseboard via 100-pin Samtec ERx8 connectors. Module size is 64 x 46.8 mm. Two adjacent slots may be combined to form a double-wide 64 x 94.4 mm module. The standard stacking height above the baseboard is 10 mm (other stacking height options are available).

There are two types of slots, Type A (P14 and P16) and Type B (P15 and P17). Type A slots provide 44 IO's, 2 dedicated clock inputs, 2 dedicated clock outputs, three 3.125 Gbps transceiver I/O pairs, one 2.5V pin, one 3.0V pin, three 3.3V pins, and one 5V pin. Type B slots provide 58 IO's, 2 dedicated clock inputs, 2 dedicated clock outputs, one 2.5V pin, one 3.0V pin, three 3.3V pins, and one 5V pin.

A double-wide module combines the A and B slots and provides the following: 102 IO's, 4 dedicated clock inputs, 4 dedicated clock outputs, three 3.125 Gbps transceiver I/O pairs, two 2.5V pins, two 3.0V pins, six 3.3V pins, and two 5V pins.

## **Multiple Control Interfaces**

In addition to I/O via piggyback modules, the Annotator Pro can accept user annotation inputs via RS232, RS422, LVDS, USB, or Ethernet. An OS-independent Java application for the user's host system is provided for setup and control. The protocol documentation can be provided for users who wish to integrate control directly into their software. Control functions include annotation location, triggering options, direct entry of static annotation strings, font size, etc. With an optional video output module, a USB keyboard can be connected directly to the Annotator Pro to provide local input of annotation text, and a limited subset of formatting controls. In the rack-mounted configuration, selected controls can be wired directly to front panel switches. A browser based configuration utility is also provided.

## **Precision Time Synchronization**

A real time clock (RTC) runs on the FPGA, and is continuously updated to either GPS time or an external IRIG-B input. In the event the GPS or IRIG input fails, the RTC will continue to run, clocked by a Connor Winfield D75F High Precision TCXO, stable to  $\pm 0.5$  ppm over a 0 to 70 °C temperature range. The sub-seconds counter on the RTC is driven by a 100 MHz clock. GPS synchronization with sub-microsecond precision is provided by an optional AHRS (SBG IG-500 or VectorNav VN-200), or the Ublox LEA-6T. The LEA-6T supports precision GPS timing for demanding positioning applications. The 50-channel positioning engine delivers hot start time-to-first-fix of less than 1 second. Cold start TTFF is less than 30 seconds. The LEA-6T provides a 5 Hz update rate. A magnetic mount active antenna is included with the GPS option. A synchronized IRIG-B output is also provided for external devices, so the Annotator Pro eliminates the need for an external time code generator.

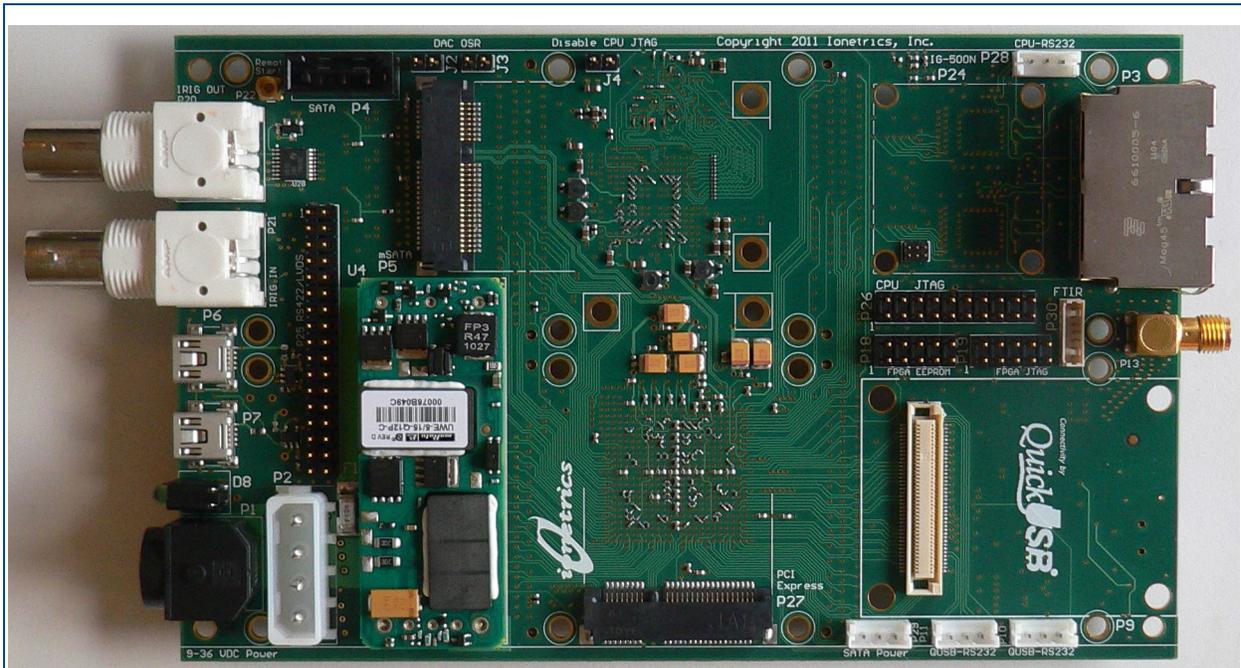
## **Dedicated USB2.0 Connection**

A high-speed USB2.0 interface is provided by an optional Bitwise Systems QuickUSB module. The QuickUSB port is a dedicated high-speed client connection to an external host system. This is not the same as the host USB connections provided by the baseboard microprocessor. The baseboard USB connections are used to connect to external devices where the Annotator Pro is the host, or to connect to external USB hubs to provide multiple connection points for USB-to-RS232 or other devices, or as a low-speed comm link to an external system.

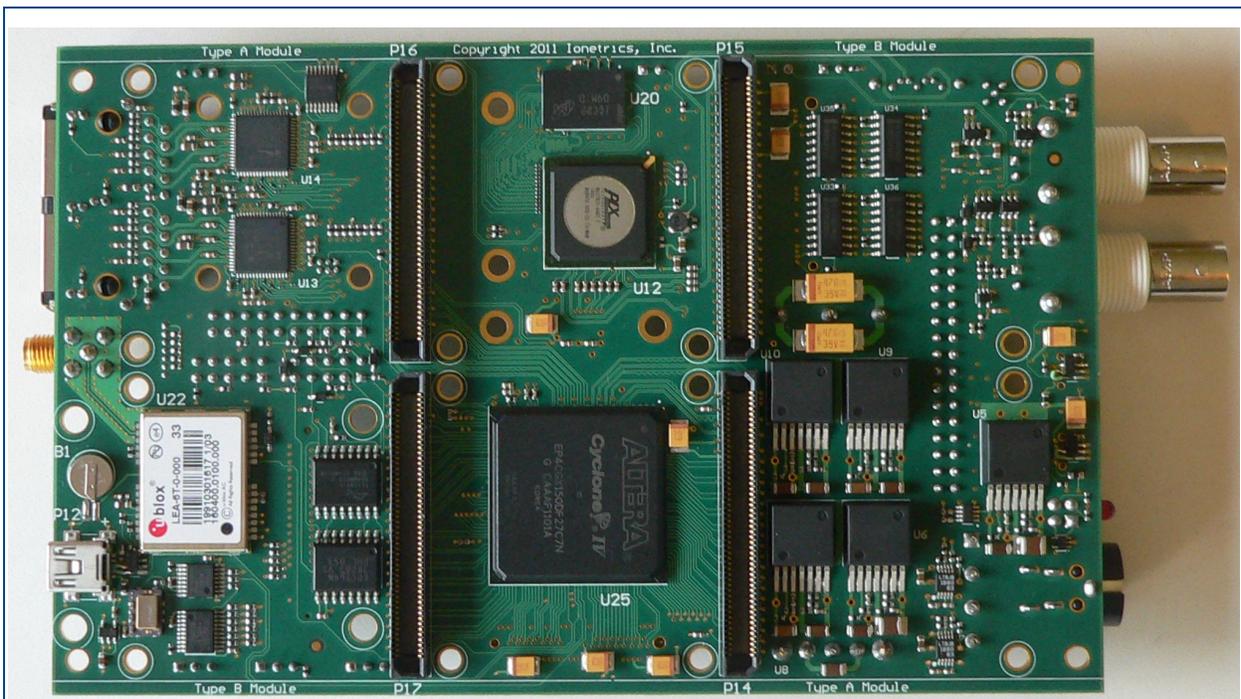


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Printed Circuit Board (Top View)



Printed Circuit Board (Bottom View)



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## **Deployment Options**

The Annotator Pro can be embedded into end-user equipment (base board size is 160 x 100 mm), or configured in a standalone enclosure (approximately 6.3 x 4.1 x 2.1 inches), or placed in a rack-mountable chassis. The Annotator Pro can be configured at build time to support a power input of either 9-36 Volts DC or 100-240 Volts AC (50-440 Hz).

The standalone enclosure is suited for connection in series between the sensor and a host computer system. The embedded configuration can be customized with application specific firmware modules, and integrated directly into the sensor enclosure. There are 2 power input connectors on the baseboard: 1) a right-angle jack (CUI PD-40, DigiKey CP-7140-ND), and 2) an ATX Molex style power connector (DigiKey 0015244449-ND). Input power is conditioned on board by a Murata UWE-5/15-Q12 “eighth-brick” DC/DC converter that can accept any input between 9V and 36V DC.

## **Optional AHRS**

An optional AHRS can be mounted directly to the Annotator Pro baseboard, or connected via a short pigtail. The pigtail option allows orientations that cannot otherwise be met with the unit fixed to the printed circuit board. Firmware support can be provided for the VectorNav VN-200, the SBG IG-500, and other units. There are 2 independent methods of acquiring AHRS data with the Annotator Pro:

- 1) The AHRS data can be injected directly into the sensor data stream, and acquired along with the primary sensor data. In this case the AHRS data is acquired at a rate that matches the primary sensor data rate.
- 2) The AHRS data can be collected as an standalone data set, independent of the data rate of the primary sensor. In this case, the AHRS data can be collected at the maximum output rate.

## **Microprocessor**

The Annotator Pro microprocessor is the PLX NAS7825. This is a dual-core ARM11MP, each core running at 750MHz. The NAS7825 is configured to boot Linux from either serial NOR flash or a SATA hard drive. Two SATA ports are provided. One port is wired to an internal mSATA interface and the other to a standard SATA connector. The mSATA interface uses the same physical connector as PCIe (see DigiKey WM3471CT-ND for the mating connector) and is wired to insure compatibility with mSATA solid-state drives. Less than 2GB of disk space is used for Linux and application software. The remainder is available for streaming live data. The second SATA connector can be connected to any standard SATA hard drive, or to an optional bracket that provides support for removable 1.8” SATA drives.

The NAS7825 also provides 2 PCI Express connections. One of these is used to interface to the FPGA. The second is wired to a standard mini-PCIe card slot. In addition to the NAS7825 to FPGA PCIe link, a portion of the NAS7825 memory space is a memory mapped interface to the FPGA.

Each of the 2 RGMII interfaces on the NAS7825 is connected to an IC Plus IP1001LF PHY to provide 2 channels of Gigabit Ethernet on standard RJ45 connectors.

The integrated NAS7825 DDR2 controller is connected to a Micron MT47H128M16RT to provide 256MB of RAM.



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## FPGA

The Annotator Pro is designed to support Cyclone IV GX FPGAs in the F672 package. This provides the following options for the FPGA:

- EP4CGX50 (49,888 LE, 2,502,000 memory bits)
- EP4CGX75 (73,920 LE, 4,158,000 memory bits)
- EP4CGX110 (109,424 LE, 5,490,000 memory bits)
- EP4CGX150 (149,760 LE, 6,480,000 memory bits)

These parts provide 393 I/Os, and eight full-duplex transceivers that can work at up to 3.125 Gbps each, and a PCI Express IP block.

Annotation data is shared via a memory mapped interface to the microprocessor. This includes GPS (time, location), AHRS (latitude, longitude, altitude, roll, pitch, heading), and IRIG time.

All FPGA IO pins are configured to operate at 3.0V, which makes them compatible with 3.3V, 3.0V, or 2.5V LVTTTL.

## Annotation Options

The Annotator Pro incorporates the same set of features as previous Annotator designs. There are two independent modes for the annotation: *Text Overlay* and *Digital Annotation*. These can be turned on and off independently.

Word	Definition
1	Year*
2	Day of Year (BCD)
3, 4	Second of Day
5, 6	Microseconds
7, 8	Frame Number
9, 10	Latitude
11, 12	Longitude
13	Altitude
14	Roll
15	Pitch
16	Heading
17	Temperature
18	Velocity
19	Pressure
20-31	0x0000
32	Checksum

The *Text Overlay* mode generates rows of text as an overlay on the output image. The annotation can be a combination of absolute IRIG time, a countdown clock (synchronized to GPS or IRIG-B), latitude, longitude, or user defined text. The number of lines of text, and the number of characters per line, depend on size of the selected font. Overlay text can change instantaneously frame-to-frame, or it can be introduced using traditional Roll, Crawl, and Reveal modes.

The text background and foreground colors can be independently set to any 24-bit value. Also, the text background and foreground can independently be set to one of four modes: *Pixel Replacement*, *Transparent*, *XOR*, and *OR*. The starting position for the text overlay can be set to any position in the image.

In the *Digital Annotation* mode, a block of 32 consecutive (on a row) pixels are replaced with the annotation data. The starting position can be set to any location in the image. This is typically put on the top line of the image in either the upper left corner or the upper right corner. Both 8-bit and 16-bit annotation modes are available. The contents of the *Digital Annotation* in 16-bit mode is shown in the table to the left.

\*Bit 15 of Year is the CaptureTrigger bit

\*Bit 14 of Year is the Locked bit